

# Water energy plan

**Focus Strand:** Water power.

## Specific Learning Outcomes:

The aim is for students to be able to understand how energy from flowing water can be transferred to wheels and turbines. How this can be used to do work.

## Key ideas and Activities:

How can we harness the energy of moving water?

Water runs downhill because of gravity pulling it down. Water can be used to move mechanical parts and create useful energy. How the wheel spins depends on the design of the wheel.

### Activity One: Water wheel

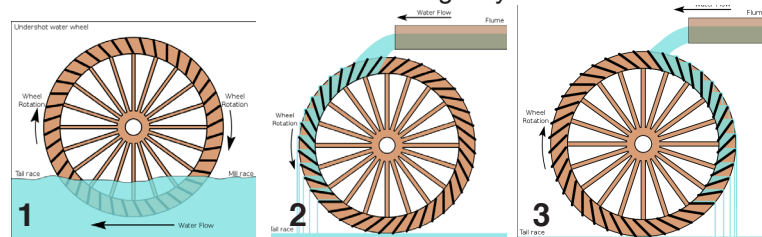
Take the kit that was built earlier and insert 4 blades anywhere into the wheel. Run water through the wheel and find which arrangement is the best. Do the same with 6 blades/ 3 blades/ 12 blades.

### Activity Two: Water flow

Take plastic guttering and use it to direct a cup of water over water wheel. Experiment with different angles, volumes and heights of the water source to find what turns the wheel the fastest.

### Activity Three: Water wheel designs

Run water over wheel in the following ways:



Undershot<sup>1</sup>, overshot<sup>2</sup> and backshot<sup>3</sup>.

See if you can see what one spins the wheel the best.

### Activity Four: Testing efficiency

Take a timer and run a cup of water over the wheel, count how many rotations it does in 10 seconds. From this work out rotations per second for the time period (rate). Use this information to find the most efficient design of the wheel from the options above.

### Activity Five: Harnessing water energy

Fix axle to wheel. Tie a length of string onto the axle of the water wheel. Tie the other end to a weight eg; a stone. Run water through the wheel and see if the energy of the water can pull the weight by winding the string around the axle. Experiment with heavier weights and different velocities of water.

### Activity Six: Building a water wheel

Following the construction instructions build a small wheel out of aluminium cans.

## Teaching Resources:

Water wheel kit-set  
Hose/ Tap  
Plastic guttering  
Stopwatch  
Aluminium wheel

## Kit materials:

3.0mm - MDF/ Cardboard/ Plastic/ Plywood

## Online:

Wheel pumping water - <http://www.youtube.com/watch?v=Lbklccv2C1>

Lorenz water wheel - <http://www.youtube.com/watch?v=zhOBibeW5J0>

# Water energy plan

WORD	DEFINE	EXPLAIN
<b>Physical:</b>		
<b>Axle</b>	The shaft a wheel rotates around or on.	Fixed axles can be used to transfer energy from water to other energy.
<b>Centripetal force</b>	The force which keeps an object moving around a curve.	In this water wheel the centripetal force is provided by <i>friction</i> between paddles and the wheel which stops them being flung off!
<b>Dam</b>	Structure that holds back water; river, sea etc.	<i>Gravitational potential energy</i> exists in water behind dam.
<b>Friction</b>	The resistance that surfaces have when in contact with each other.	When surfaces move against each other they are slowed down, which creates heat. For example rubbing your hands together makes them warm!
<b>Inertia</b>	The property of mass which causes it to resist changes to its location or velocity.	It takes force to make an object move or change direction. It's easier to throw a tennis ball than a shot-put because the shot-put has more inertia.
<b>Momentum</b>	The combination of velocity and weight of an object.	A heavy thing is harder to stop than a light one. It has more momentum/ <i>kinetic energy</i> .
<b>Rate</b>	The speed at which something happens.	When the wheel spins faster it is spinning at a faster rate.
<b>Turbine</b>	Spins, converting kinetic energy in water or air to electricity or mechanical work.	A turbine is more <i>efficient</i> than a water wheel at changing <i>kinetic energy</i> to electricity and other forms of energy.
<b>Volume</b>	The space taken up by an object.	Volume is not related to mass but just how much large it is.
<b>Energy:</b>		
<b>Energy efficient</b>	Using the most of energy without waste.	Changing energy from one form to another often results in energy lost as heat or sound. Efficiency is minimising this.
<b>Gravitational potential energy</b>	Energy that exists because of the difference in height between objects. Usually an object and the earth.	When an object is raised above the ground it has the potential to fall ( <i>kinetic energy</i> ). This potential is potential gravitational energy.
<b>Thermal energy</b>	Energy that exists as heat.	This is the energy we use to stay warm but it is also often generated when it isn't wanted due to inefficiency. A cars engine heats up because of this, rather than using all the energy in the fuel as <i>kinetic energy</i> .
<b>Energy:</b>		
<b>Angle</b>	The space between two lines that join at one end.	
<b>Anticlockwise/ Clock-wise</b>	Spins to the left, in the opposite way to a clock. Spins to the right like a clock.	
<b>Equally</b>	Having the same amount as another.	
<b>Factors</b>	Something that contributes to a result.	
<b>Hexagon</b>	A six-sided shape.	